



\*\*\*\*\*IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Filing Date: 11/10/2003                      Applicant: Jackson Hsieh  
Examiner: ROSE, KIESHA L                      Art Unit: 2822  
Title                      IMAGE SENSOR PACKAGE  
To:                      THE ASSISTANT COMMISSIONER FOR PATENTS  
                            Washington, D.C. 20231

**RESPONSE TO OFFICE ACTION**

Dear Sir:

In response to the Office Action dated 02/25/2005, Applicant submits the  
5 following amendment and argument.

**AMENDMENT**

**IN THE SPECIFICATION**

**STACKED SMALL MEMORY CARD**

Background of the Invention

10 Field of the Invention

The invention relates to an image sensor module, and more particularly to  
an image sensor with increased product reliability and facilitated manufacturing  
processes.

Description of the Related Art

15 Referring to FIG. 1, which is a cross-sectional view showing an image  
sensor package. The image sensor includes a plurality of lower metal sheets10  
arranged in an array, each of the lower metal sheets10 having an upper surface26  
and a lower surface28. A plurality of upper metal sheets12 arranged in an array,

each of the upper metal sheets12 having an upper surface38 and a lower surface40, the lower surfaces 40 of the upper metal sheets 12 being stacked on the upper surfaces 26 of the lower metal sheets10. An encapsulant14 for encapsulating the lower metal sheets10 and the upper metal sheets12. Wherein the upper surfaces38  
5 of the upper metal sheets12 are exposed from the encapsulant14. The lower surfaces28 of the lower metal sheets10 are exposed from the encapsulant14 and electrically connected to the printed circuit board 32 through tin 30 by the way of surface mount technique (SMT), and the encapsulant14 is formed with a frame layer16 around the upper surfaces38 of the upper metal sheets12 to define a  
10 chamber42 together with the upper metal sheets12. A photosensitive chip18 arranged within the chamber. A plurality of wires20 for electrically connecting the photosensitive chip18 to the upper surfaces38 of the upper metal sheets12. A transparent layer22 arranged on the frame layer16 of the encapsulant14 to cover the photosensitive chip18.

15       The above-mentioned the patent has some advantages, but it has following drawbacks.

1. Since the wires 20 are electrically connected the chip18 to the upper surface38 of the upper metal sheets12 for transmitting signals from the chip18 to the lower metal sheets12. Thus, the upper metals12 and the lower metal sheets10  
20 much be tight stacked.

#### Summary of the invention

An object of the invention is to provide an image sensor with improved

package reliability.

Still another object of the invention is to provide an image sensor, wherein the wire bonding process may be easily performed and the product yield may be increased.

5           To achieve the above-mentioned objects, the invention includes plural lower metal sheets, plural upper metal sheets stacked on the lower metal sheets, and an encapsulant for encapsulating the lower and upper metal sheets. The lower metal formed with a first hole, the upper metal sheets formed a second hole penetrated from the upper surface to the lower surface. Wherein the encapsulant filled into  
10 the second hole and first hole to tighten the upper metal sheets and the lower metal sheets. A photosensitive chip arranged within the chamber, plural wires for electrically connecting the chip to the upper surfaces of the lower metal sheets, and a transparent layer arranged on the frame layer to cover the chip.

#### Brief description of the drawings

15           FIG. 1 is a cross-sectional view showing an image sensor package.

FIG. 2 is a cross-sectional view showing an image sensor package of the invention.

FIG. 3 is a first schematic view showing an image sensor package of the invention.

20           FIG. 4 is a second schematic view showing an image sensor of the invention.

FIG.5 is a third schematic view showing an image sensor package of the invention.

#### DETAILED DESCRIPTION OF THE invention

Referring to FIG. 2, an image sensor of the invention includes a plurality  
5 of lower metal sheets 46 arranged in an array, a plurality of upper metal sheets  
48 arranged in an array, an encapsulant 50, a frame layer 52, a photosensitive chip  
54, a plurality of wires 56, and a transparent layer 58.

Please referring to FIG.3 and FIG.4, Each lower metal sheet 46 has an upper  
surface 60 and a lower surface 62, and formed with a first hole 64, which is a  
10 cavity.

Each of the upper metal sheet 48 has an upper surface 68 and a lower  
surface 70, and formed with a second hole 72 penetrated from the upper surface 68  
to the lower surface 70. The lower surfaces 70 of the upper metal sheets 48 are  
stacked on the upper surfaces 60 of the lower metal sheets 46, then the second  
15 hole 72 corresponding with the first hole 64.

The encapsulant 54 is encapsulated the lower metal sheets 46 and the upper  
metal sheets 48 via integrated mold, and filled into the first hole 64 and the second  
hole 72 to tighten the lower metal sheets 46 and upper metal sheets 48. Wherein the  
upper surfaces 60 of the lower metal sheets 46 are exposed from the encapsulant 54.  
20 The lower surfaces 62 of the lower metal sheets 46 are exposed from the  
encapsulant 54 and electrically connected to the printed circuit board 32 via  
solder 30. The encapsulant 54 is formed with a frame layer 52 around the upper

surfaces 68 of the upper metal sheets 48 to define a chamber 74 together with the upper metal sheets 48.

The photosensitive chip 54 is arranged on the middle board 67 and located within the chamber 74.

5       The plurality of wires 56 are electrically connected the photosensitive chip 54 to the upper surfaces 60 of the upper metal sheets 46 so as to transfer signals from the photosensitive chip 54 to the lower metal sheets 46.

      The transparent layer 58 is a piece of transparent glass arranged on the frame layer 52 of the encapsulant 50 to cover the photosensitive chip 54. Thus, the  
10   photosensitive chip 54 may receive optical signals passing through the transparent layer 58.

      The invention has the following advantages.

1. Since the combination of the upper and lower metal sheets 48 and 46 is thicker, the solder 30 may climb to the upper metal sheets 48 from the  
15   lower metal sheets 46 during the SMT process for mounting the image sensor to the printed circuit board 32. Therefore, the package body can be mounted to the printed circuit board 32 with great stability.

2. Since the encapsulant 54 is filled into the first hole 64 and first hole 72, so as to the upper metal sheets 48 and lower metal sheets 46 may package  
20   tight.

While the invention has been described by way of examples and in terms of preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments. To the contrary, it is intended to cover various modifications. Therefore, the scope of the appended claims should be accorded  
5 the broadest interpretation so as to encompass all such modifications.